



SEQUENCE LISTING

<110> ARNOLD, Frances H.
PETROUNIA, Ionna P.
SUN, Lianhong

<120> DIRECTED EVOLUTION OF OXIDASE ENZYMES

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<140> US 09/722,602

<141> 2000-11-27

<150> US 09/571,553

<151> 2000-05-16

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<210> 10

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<212> PRT

<213> Dactylium dendroides

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Gly	Asn	Lys	Asp	Thr	Phe	Trp	His	Thr	Phe	Tyr	Gly	Ala	Asn	Gly	Asp
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Pro	Lys	Pro	Pro	His	Thr	Tyr	Thr	Ile	Asp	Met	Lys	Thr	Thr	Gln	Asn
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Val	Asn	Gly	Leu	Ser	Met	Leu	Pro	Arg	Gln	Asp	Gly	Asn	Gln	Asn	Gly

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Trp	Ile	Gly	Arg	His	Glu	Val	Tyr	Leu	Ser	Ser	Asp	Gly	Thr	Asn	Trp
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Tyr	Ser	Asn	Phe	Glu	Thr	Arg	Pro	Ala	Arg	Tyr	Val	Arg	Leu	Val	Ala
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Ile	Thr	Glu	Ala	Asn	Gly	Gln	Pro	Trp	Thr	Ser	Ile	Ala	Glu	Ile	Asn
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Val	Phe	Gln	Ala	Ser	Ser	Tyr	Thr	Ala	Pro	Gln	Pro	Gly	Leu	Gly	Arg
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Trp	Gly	Pro	Thr	Ile	Asp	Leu	Pro	Ile	Val	Pro	Ala	Ala	Ala	Ala	Ile
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Glu	Pro	Thr	Ser	Gly	Arg	Val	Leu	Met	Trp	Ser	Ser	Tyr	Arg	Asn	Asp
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Ala	Phe	Gly	Gly	Ser	Pro	Gly	Gly	Ile	Thr	Leu	Thr	Ser	Ser	Trp	Asp
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Val	Thr	Gly	Gly	Asn	Asp	Ala	Lys	Lys	Thr	Ser	Leu	Tyr	Asp	Ser	Ser
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Gln	Ser	Ser	Ala	Thr	Met	Ser	Asp	Gly	Arg	Val	Phe	Thr	Ile	Gly	Gly
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Glu Asp Ser Thr Pro	Val Phe Thr Pro	Glu Ile Tyr Val Pro	Glu Gln	
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Asp Thr Phe Tyr Lys	Gln Asn Pro Asn	Ser Ile Val Arg Val	Tyr His	
	485	490	495	
Ser Ile Ser Leu Leu	Leu Pro Asp Gly	Arg Val Phe Asn	Gly Gly	
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Gly Leu Cys Gly Asp	Cys Thr Thr Asn	His Phe Asp Ala	Gln Ile Phe	
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Thr Pro Asn Tyr Leu	Tyr Asn Ser Asp	Gly Asn Leu Ala	Thr Arg Pro	
	530	535	540	
Lys Ile Thr Arg Thr	Ser Thr Gln Ser	Val Lys Val Gly	Gly Arg Ile	
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Thr Ile Ser Thr Asp	Ser Ser Ile Ser	Lys Ala Ser Leu	Ile Arg Tyr	
	565	570	575	
Gly Thr Ala Thr His	Thr Val Asn Thr	Asp Gln Arg Arg	Ile Pro Leu	
	580	585	590	
Thr Leu Thr Asn Asn	Gly Gly Asn Ser	Tyr Ser Phe Gln	Val Pro Ser	
	595	600	605	
Asp Ser Gly Val Ala	Leu Pro Gly Tyr	Trp Met Leu Phe	Val Met Asn	
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<210> 11
 <211> 639
 <212> PRT
 <213> Dactylium dendroides

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35 40 45
Pro Lys Pro Pro His Thr Tyr Thr Ile Asp Met Lys Thr Thr Gln Asn
50 55 60
Val Asn Gly Leu Ser Met Leu Pro Arg Gln Asp Gly Asn Gln Asn Gly
65 70 75 80
Trp Ile Gly Arg His Glu Val Tyr Leu Ser Ser Asp Gly Thr Asn Trp
85 90 95
Gly Ser Pro Val Ala Ser Gly Ser Trp Phe Ala Asp Ser Thr Thr Lys
100 105 110
Tyr Ser Asn Phe Glu Thr Arg Pro Ala Arg Tyr Val Arg Leu Val Ala
115 120 125
Ile Thr Glu Ala Asn Gly Gln Pro Trp Thr Ser Ile Ala Glu Ile Asn
130 135 140

Val	Phe	Gln	Ala	Ser	Ser	Tyr	Thr	Ala	Pro	Gln	Pro	Gly	Leu	Gly	Arg
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Trp	Gly	Pro	Thr	Ile	Asp	Leu	Pro	Ile	Val	Pro	Ala	Ala	Ala	Ala	Ile
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Glu	Pro	Thr	Ser	Gly	Arg	Val	Leu	Met	Trp	Ser	Ser	Tyr	Arg	Asn	Asp
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Ala	Phe	Gly	Gly	Ser	Pro	Gly	Gly	Ile	Thr	Leu	Thr	Ser	Ser	Trp	Asp
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Pro	Ser	Thr	Gly	Ile	Val	Ser	Asp	Arg	Thr	Val	Thr	Val	Thr	Lys	His
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Val	Thr	Gly	Gly	Asn	Asp	Ala	Lys	Lys	Thr	Ser	Leu	Tyr	Asp	Ser	Ser
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Ser	Asp	Ser	Trp	Ile	Pro	Gly	Pro	Asp	Met	Gln	Val	Ala	Arg	Gly	Tyr
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Gln	Ser	Ser	Ala	Thr	Met	Ser	Asp	Gly	Arg	Val	Phe	Thr	Ile	Gly	Gly
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Ser	Trp	Ser	Gly	Gly	Val	Phe	Glu	Lys	Asn	Gly	Glu	Val	Tyr	Ser	Pro
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Leu	Phe	Gly	Trp	Lys	Lys	Gly	Ser	Val	Phe	Gln	Ala	Gly	Pro	Ser	Thr
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Ile	Thr	Leu	Gly	Glu	Pro	Gly	Thr	Ser	Pro	Asn	Thr	Val	Phe	Ala	Ser
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Asn	Gly	Leu	Tyr	Phe	Ala	Arg	Thr	Phe	His	Thr	Ser	Val	Val	Leu	Pro
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Asp	Gly	Ser	Thr	Phe	Ile	Thr	Gly	Gly	Gln	Arg	Arg	Gly	Ile	Pro	Phe
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Glu	Asp	Ser	Thr	Pro	Val	Phe	Thr	Pro	Glu	Ile	Tyr	Val	Pro	Glu	Gln
465					470					475					480
Asp	Thr	Phe	Tyr	Lys	Gln	Asn	Pro	Asn	Ser	Ile	Val	Arg	Ala	Tyr	His
				485					490					495	
Ser	Ile	Ser	Leu	Leu	Leu	Pro	Asp	Gly	Arg	Val	Phe	Asn	Gly	Gly	Gly
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Thr	Pro	Asn	Tyr	Leu	Tyr	Asn	Ser	Asn	Gly	Asn	Leu	Ala	Thr	Arg	Pro
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Thr	Ile	Ser	Thr	Asp	Ser	Ser	Ile	Ser	Lys	Ala	Ser	Leu	Ile	Arg	Tyr
				565					570					575	
Gly	Thr	Ala	Thr	His	Thr	Val	Asn	Thr	Asp	Gln	Arg	Arg	Ile	Pro	Leu
				580				585					590		
Thr	Leu	Thr	Asn	Asn	Gly	Gly	Asn	Ser	Tyr	Ser	Phe	Gln	Val	Pro	Ser
			595				600					605			
Asp	Ser	Gly	Val	Ala	Leu	Pro	Gly	Tyr	Trp	Met	Leu	Phe	Val	Met	Asn
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 <213> Dactylium dendroides

<400> 12

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Gly	Asn	Lys	Asp	Thr	Phe	Trp	His	Thr	Phe	Tyr	Gly	Ala	Asn	Gly	Asp
		35					40					45			
Pro	Lys	Pro	Pro	His	Thr	Tyr	Thr	Ile	Asp	Met	Lys	Thr	Thr	Gln	Asn
	50					55					60				
Val	Asn	Gly	Leu	Ser	Met	Leu	Pro	Arg	Gln	Asp	Gly	Asn	Gln	Asn	Gly
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Trp	Ile	Gly	Arg	His	Glu	Val	Tyr	Leu	Ser	Ser	Asp	Gly	Thr	Asn	Trp
				85					90					95	
Gly	Ser	Pro	Val	Ala	Ser	Gly	Ser	Trp	Phe	Ala	Asp	Ser	Thr	Thr	Lys
			100					105					110		
Tyr	Ser	Asn	Phe	Glu	Thr	Arg	Pro	Ala	Arg	Tyr	Val	Arg	Leu	Val	Ala
		115					120					125			
Ile	Thr	Glu	Ala	Asn	Gly	Gln	Pro	Trp	Thr	Ser	Ile	Ala	Glu	Ile	Asn
	130					135					140				
Val	Phe	Gln	Ala	Ser	Ser	Tyr	Thr	Ala	Pro	Gln	Pro	Gly	Leu	Gly	Arg
145					150					155					160
Trp	Gly	Pro	Thr	Ile	Asp	Leu	Pro	Ile	Val	Pro	Ala	Ala	Ala	Ala	Ile
				165					170					175	
Glu	Pro	Thr	Ser	Gly	Arg	Val	Leu	Met	Trp	Ser	Ser	Tyr	Arg	Asn	Asp
			180					185					190		
Ala	Phe	Gly	Gly	Ser	Pro	Gly	Gly	Ile	Thr	Leu	Thr	Ser	Ser	Trp	Asp
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Pro	Ser	Thr	Gly	Ile	Val	Ser	Asp	Arg	Thr	Val	Thr	Val	Thr	Lys	His

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Asp Met Phe Cys Pro Gly Ile Ser Met Asp Gly Asn Gly Gln Ile Val		
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Val Thr Gly Gly Asn Asp Ala Lys Lys Thr Ser Leu Tyr Asp Ser Ser		240
	245	250
Ser Asp Ser Trp Ile Pro Gly Pro Asp Met Gln Val Ala Arg Gly Tyr		255
	260	265
Gln Ser Ser Ala Thr Met Ser Asp Gly Arg Val Phe Thr Ile Gly Gly		270
	275	280
Ser Trp Ser Gly Gly Val Phe Glu Lys Asn Gly Glu Val Tyr Ser Pro		285
	290	295
Ser Ser Lys Thr Trp Thr Ser Leu Pro Asn Ala Lys Val Asn Pro Met		300
305	310	315
Leu Thr Ala Asp Lys Gln Gly Leu Tyr Arg Ser Asp Asn His Ala Trp		320
	325	330
Leu Phe Gly Trp Lys Lys Gly Ser Val Phe Gln Ala Gly Pro Ser Thr		335
	340	345
Ala Met Asn Trp Tyr Tyr Thr Ser Gly Ser Gly Asp Val Lys Ser Ala		350
	355	360
Gly Lys Arg Gln Ser Asn Arg Gly Val Ala Pro Asp Ala Met Cys Gly		365
	370	375
Asn Ala Val Met Tyr Asp Ala Val Lys Gly Lys Ile Leu Thr Phe Gly		380
385	390	395
Gly Ser Pro Asp Tyr Gln Asp Ser Asp Ala Thr Thr Asn Ala His Ile		400
	405	410
Ile Thr Leu Gly Glu Pro Gly Thr Ser Pro Asn Thr Val Phe Ala Ser		415
	420	425
Asn Gly Leu Tyr Phe Ala Arg Thr Phe His Thr Ser Val Val Leu Pro		430
	435	440
Asp Gly Ser Thr Phe Ile Thr Gly Gly Gln Arg Arg Gly Ile Pro Phe		445
	450	455
Glu Asp Ser Thr Pro Val Phe Thr Pro Glu Ile Tyr Val Pro Glu Gln		460
465	470	475
Asp Thr Phe Tyr Lys Gln Asn Pro Asn Ser Ile Val Arg Ala Tyr His		480
	485	490
Ser Ile Ser Leu Leu Leu Pro Asp Gly Arg Val Phe Asn Gly Gly Gly		495
	500	505
Gly Leu Cys Gly Asp Cys Thr Thr Asn His Phe Asp Ala Gln Ile Phe		510
	515	520
Thr Pro Asn Tyr Leu Tyr Asn Ser Asn Gly Asn Leu Ala Thr Arg Pro		525
	530	535
Lys Ile Thr Arg Thr Ser Thr Gln Ser Val Lys Val Gly Gly Arg Ile		540
545	550	555
Thr Ile Ser Thr Asp Ser Ser Ile Ser Lys Ala Ser Leu Ile Arg Tyr		560
	565	570
Gly Thr Ala Thr His Thr Val Asn Thr Asp Gln Arg Arg Ile Pro Leu		575
	580	585
Thr Leu Thr Asn Asn Gly Gly Asn Ser Tyr Ser Phe Gln Val Pro Ser		590

	595		600		605
Asp	Ser Gly Val Ala Leu Pro Gly Tyr Trp Met Leu Phe Val Met Asn				
610		615		620	
Ser Ala Gly Val Pro Ser Val Ala Ser Thr Ile Arg Val Thr Gln					
625		630		635	

<210> 13
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 <213> Dactylium dendroides

<400> 13

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Gly	Asn	Lys	Asp	Thr	Phe	Trp	His	Thr	Phe	Tyr	Gly	Ala	Asn	Gly	Asp
		35					40					45			
Pro	Lys	Pro	Pro	His	Thr	Tyr	Thr	Ile	Asp	Met	Lys	Thr	Thr	Gln	Asn
	50					55					60				
Val	Asn	Gly	Leu	Ser	Met	Leu	Pro	Arg	Gln	Asp	Gly	Asn	Gln	Asn	Gly
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Trp	Ile	Gly	Arg	His	Glu	Val	Tyr	Leu	Ser	Ser	Asp	Gly	Thr	Asn	Trp
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Gly	Ser	Pro	Val	Ala	Ser	Gly	Ser	Trp	Phe	Ala	Asp	Ser	Thr	Thr	Lys
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Tyr	Ser	Asn	Phe	Glu	Thr	Arg	Pro	Ala	Arg	Tyr	Val	Arg	Leu	Val	Ala
		115					120					125			
Ile	Thr	Glu	Ala	Asn	Gly	Gln	Pro	Trp	Thr	Ser	Ile	Ala	Glu	Ile	Asn
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Val	Phe	Gln	Ala	Ser	Ser	Tyr	Thr	Ala	Pro	Gln	Pro	Gly	Leu	Gly	Arg
145					150					155					160
Trp	Gly	Pro	Thr	Ile	Asp	Leu	Pro	Ile	Val	Pro	Ala	Ala	Ala	Ala	Ile
				165					170					175	
Glu	Pro	Thr	Ser	Gly	Arg	Val	Leu	Met	Trp	Ser	Ser	Tyr	Arg	Asn	Asp
			180					185					190		
Ala	Phe	Gly	Gly	Ser	Pro	Gly	Gly	Ile	Thr	Leu	Thr	Ser	Ser	Trp	Asp
		195					200					205			
Pro	Ser	Thr	Gly	Ile	Val	Ser	Asp	Arg	Thr	Val	Thr	Val	Thr	Lys	His
	210					215						220			
Asp	Met	Phe	Cys	Pro	Gly	Ile	Ser	Met	Asp	Gly	Asn	Gly	Gln	Ile	Val
225					230					235					240
Val	Thr	Gly	Gly	Asn	Asp	Ala	Lys	Lys	Thr	Ser	Leu	Tyr	Asp	Ser	Ser
				245					250					255	
Ser	Asp	Ser	Trp	Ile	Pro	Gly	Pro	Asp	Met	Gln	Val	Ala	Arg	Gly	Tyr
			260					265					270		
Gln	Ser	Ser	Ala	Thr	Met	Ser	Asp	Gly	Arg	Val	Phe	Thr	Ile	Gly	Gly
			275				280						285		

Ser	Trp	Ser	Gly	Gly	Val	Phe	Glu	Lys	Asn	Gly	Glu	Val	Tyr	Ser	Pro
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Ser	Ser	Lys	Thr	Trp	Thr	Ser	Leu	Pro	Asn	Ala	Lys	Val	Asn	Pro	Met
305					310					315					320
Leu	Thr	Ala	Asp	Lys	Gln	Gly	Leu	Tyr	Arg	Ser	Asp	Asn	His	Ala	Trp
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Leu	Phe	Gly	Trp	Lys	Lys	Gly	Ser	Val	Phe	Gln	Ala	Gly	Pro	Ser	Thr
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Ala	Met	Asn	Trp	Tyr	Tyr	Thr	Ser	Gly	Ser	Gly	Asp	Val	Lys	Ser	Ala
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Gly	Lys	Arg	Gln	Ser	Asn	Arg	Gly	Val	Ala	Pro	Asp	Ala	Met	Cys	Gly
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Asn	Ala	Val	Met	Tyr	Asp	Ala	Val	Lys	Gly	Lys	Ile	Leu	Thr	Phe	Gly
385					390					395					400
Gly	Ser	Pro	Asp	Tyr	Gln	Asp	Ser	Asp	Ala	Thr	Thr	Asn	Ala	His	Ile
				405					410					415	
Ile	Thr	Leu	Gly	Glu	Pro	Gly	Thr	Ser	Pro	Asn	Thr	Val	Phe	Ala	Ser
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Asn	Gly	Leu	Tyr	Phe	Ala	Arg	Thr	Phe	His	Thr	Ser	Val	Val	Leu	Pro
		435					440					445			
Asp	Gly	Ser	Thr	Phe	Ile	Thr	Gly	Gly	Gln	Arg	Arg	Gly	Ile	Pro	Phe
	450					455					460				
Glu	Asp	Ser	Thr	Pro	Val	Phe	Thr	Pro	Glu	Ile	Tyr	Val	Pro	Glu	Gln
465					470					475					480
Asp	Thr	Phe	Tyr	Lys	Gln	Asn	Pro	Asn	Ser	Ile	Val	Arg	Ala	Tyr	His
				485					490					495	
Ser	Ile	Ser	Leu	Leu	Leu	Pro	Asp	Gly	Arg	Val	Phe	Asn	Gly	Gly	Gly
			500					505					510		
Gly	Leu	Cys	Gly	Asp	Cys	Thr	Thr	Asn	His	Phe	Asp	Ala	Gln	Ile	Phe
		515					520					525			
Thr	Pro	Asn	Tyr	Leu	Tyr	Asn	Ser	Asn	Gly	Asn	Leu	Ala	Thr	Arg	Pro
	530					535					540				
Lys	Ile	Thr	Arg	Thr	Ser	Thr	Gln	Ser	Val	Lys	Val	Gly	Gly	Arg	Ile
545					550					555					560
Thr	Ile	Ser	Thr	Asp	Ser	Ser	Ile	Ser	Lys	Ala	Ser	Leu	Ile	Arg	Tyr
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Gly	Thr	Ala	Thr	His	Thr	Val	Asn	Thr	Asp	Gln	Arg	Arg	Ile	Pro	Leu
			580					585					590		
Thr	Leu	Thr	Asn	Asn	Gly	Gly	Asn	Ser	Tyr	Ser	Phe	Gln	Val	Pro	Ser
		595					600					605			
Asp	Ser	Gly	Val	Ala	Leu	Pro	Gly	Tyr	Trp	Met	Leu	Phe	Val	Met	Asn
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Ser	Ala	Gly	Val	Pro	Ser	Val	Ala	Ser	Thr	Ile	Arg	Val	Thr	Gln	
625					630					635					

<210> 14
 <211> 639
 <212> PRT

<213> Dactylium dendroides

<400> 14

Ala	Ser	Ala	Pro	Ile	Gly	Ser	Ala	Ile	Ser	Arg	Asn	Asn	Trp	Ala	Val
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Thr	Cys	Asp	Ser	Ala	Gln	Ser	Gly	Asn	Glu	Cys	Asn	Lys	Ala	Ile	Asp
			20					25					30		
Gly	Asn	Lys	Asp	Thr	Phe	Trp	His	Thr	Phe	Tyr	Gly	Ala	Asn	Gly	Asp
		35					40					45			
Pro	Lys	Pro	Pro	His	Thr	Tyr	Thr	Ile	Asp	Met	Lys	Thr	Thr	Gln	Asn
	50					55					60				
Val	Asn	Gly	Leu	Ser	Met	Leu	Pro	Arg	Gln	Asp	Gly	Asn	Gln	Asn	Gly
65					70					75					80
Trp	Ile	Gly	Arg	His	Glu	Val	Tyr	Leu	Ser	Ser	Asp	Gly	Thr	Asn	Trp
				85					90					95	
Gly	Ser	Pro	Val	Ala	Ser	Gly	Ser	Trp	Phe	Ala	Asp	Ser	Thr	Thr	Lys
			100					105					110		
Tyr	Ser	Asn	Phe	Glu	Thr	Arg	Pro	Ala	Arg	Tyr	Val	Arg	Leu	Val	Ala
		115					120					125			
Ile	Thr	Glu	Ala	Asn	Gly	Gln	Pro	Trp	Thr	Ser	Ile	Ala	Glu	Ile	Asn
		130				135					140				
Val	Phe	Gln	Ala	Ser	Ser	Tyr	Thr	Ala	Pro	Gln	Pro	Gly	Leu	Gly	Arg
145					150					155					160
Trp	Gly	Pro	Thr	Ile	Asp	Leu	Pro	Ile	Val	Pro	Ala	Ala	Ala	Ala	Ile
				165					170					175	
Glu	Pro	Thr	Ser	Gly	Arg	Val	Leu	Met	Trp	Ser	Ser	Tyr	Arg	Asn	Asp
			180					185					190		
Ala	Phe	Glu	Gly	Ser	Pro	Gly	Gly	Ile	Thr	Leu	Thr	Ser	Ser	Trp	Asp
		195					200					205			
Pro	Ser	Thr	Gly	Ile	Val	Ser	Asp	Arg	Thr	Val	Thr	Val	Thr	Lys	His
	210					215					220				
Asp	Met	Phe	Cys	Pro	Gly	Ile	Ser	Met	Asp	Gly	Asn	Gly	Gln	Ile	Val
225					230					235					240
Val	Thr	Gly	Gly	Asn	Asp	Ala	Lys	Lys	Thr	Ser	Leu	Tyr	Asp	Ser	Ser
				245					250					255	
Ser	Asp	Ser	Trp	Ile	Pro	Gly	Pro	Asp	Met	Gln	Val	Ala	Arg	Gly	Tyr
			260					265					270		
Gln	Ser	Ser	Ala	Thr	Met	Ser	Asp	Gly	Arg	Val	Phe	Thr	Ile	Gly	Gly
		275					280					285			
Ser	Trp	Ser	Gly	Gly	Val	Phe	Glu	Lys	Asn	Gly	Glu	Val	Tyr	Ser	Pro
	290					295					300				
Ser	Ser	Lys	Thr	Trp	Thr	Ser	Leu	Pro	Asn	Ala	Lys	Val	Asn	Pro	Met
305					310					315					320
Leu	Thr	Ala	Asp	Lys	Gln	Gly	Leu	Tyr	Arg	Ser	Asp	Asn	His	Ala	Trp
			325						330					335	
Leu	Phe	Gly	Trp	Lys	Lys	Gly	Ser	Val	Phe	Gln	Ala	Gly	Pro	Ser	Thr
			340					345					350		
Ala	Met	Asn	Trp	Tyr	Tyr	Thr	Ser	Gly	Ser	Gly	Asp	Val	Lys	Ser	Ala

Pro	Lys	Pro	Pro	His	Thr	Tyr	Thr	Ile	Asp	Met	Lys	Thr	Thr	Gln	Asn
50						55					60				
Val	Asn	Gly	Leu	Ser	Met	Leu	Pro	Arg	Gln	Asp	Gly	Asn	Gln	Asn	Gly
65					70					75					80
Trp	Ile	Gly	Arg	His	Glu	Val	Tyr	Leu	Ser	Ser	Asp	Gly	Thr	Asn	Trp
				85					90					95	
Gly	Ser	Pro	Val	Ala	Ser	Gly	Ser	Trp	Phe	Ala	Asp	Ser	Thr	Thr	Lys
			100					105					110		
Tyr	Ser	Asn	Phe	Glu	Thr	Arg	Pro	Ala	Arg	Tyr	Val	Arg	Leu	Val	Ala
		115					120					125			
Ile	Thr	Glu	Ala	Asn	Gly	Gln	Pro	Trp	Thr	Ser	Ile	Ala	Glu	Ile	Asn
	130					135					140				
Val	Phe	Gln	Ala	Ser	Ser	Tyr	Thr	Ala	Pro	Gln	Pro	Gly	Leu	Gly	Arg
145					150					155					160
Trp	Gly	Pro	Thr	Ile	Asp	Leu	Pro	Ile	Val	Pro	Ala	Ala	Ala	Ala	Ile
				165					170					175	
Glu	Pro	Thr	Ser	Gly	Arg	Val	Leu	Met	Trp	Ser	Ser	Tyr	Arg	Asn	Asp
			180					185					190		
Ala	Phe	Gly	Gly	Ser	Pro	Gly	Gly	Ile	Thr	Leu	Thr	Ser	Ser	Trp	Asp
		195					200					205			
Pro	Ser	Thr	Gly	Ile	Val	Ser	Asp	Arg	Thr	Val	Thr	Val	Thr	Lys	His
	210					215					220				
Asp	Met	Phe	Cys	Pro	Gly	Ile	Ser	Met	Asp	Gly	Asn	Gly	Gln	Ile	Val
225					230					235					240
Val	Thr	Gly	Gly	Asn	Asp	Ala	Lys	Lys	Thr	Ser	Leu	Tyr	Asp	Ser	Ser
				245					250					255	
Ser	Asp	Ser	Trp	Ile	Pro	Gly	Pro	Asp	Met	Gln	Val	Ala	Arg	Gly	Tyr
			260					265					270		
Gln	Ser	Ser	Ala	Thr	Met	Ser	Asp	Gly	Arg	Val	Phe	Thr	Ile	Gly	Gly
		275					280					285			
Ser	Trp	Ser	Gly	Gly	Val	Phe	Glu	Lys	Asn	Gly	Glu	Val	Tyr	Ser	Pro
	290					295					300				
Ser	Ser	Lys	Thr	Trp	Thr	Ser	Leu	Pro	Asn	Ala	Lys	Val	Asn	Pro	Met
305					310					315					320
Leu	Thr	Ala	Asp	Lys	Gln	Gly	Leu	Tyr	Arg	Ser	Asp	Asn	His	Ala	Trp
				325					330					335	
Leu	Phe	Gly	Trp	Lys	Lys	Gly	Ser	Val	Phe	Gln	Ala	Gly	Pro	Ser	Thr
			340					345					350		
Ala	Met	Asn	Trp	Tyr	Tyr	Thr	Ser	Gly	Ser	Gly	Asp	Val	Lys	Ser	Ala
		355					360					365			
Gly	Lys	Arg	Gln	Ser	Asn	Arg	Gly	Val	Ala	Pro	Asp	Ala	Met	Cys	Gly
	370					375					380				
Asn	Ala	Val	Met	Tyr	Asp	Ala	Val	Lys	Gly	Lys	Ile	Leu	Thr	Phe	Gly
385					390					395					400
Gly	Ser	Pro	Asp	Tyr	Gln	Asp	Ser	Asp	Ala	Thr	Thr	Asn	Ala	His	Ile
				405					410					415	
Ile	Thr	Leu	Gly	Glu	Pro	Gly	Thr	Ser	Pro	Asn	Thr	Val	Phe	Ala	Ser
			420					425					430		

Asn	Gly	Leu	Tyr	Phe	Ala	Arg	Thr	Phe	His	Thr	Ser	Val	Val	Leu	Pro
	435						440					445			
Asp	Gly	Ser	Thr	Phe	Ile	Thr	Gly	Gly	Gln	Arg	Arg	Gly	Ile	Pro	Phe
	450					455					460				
Glu	Asp	Ser	Thr	Pro	Val	Phe	Thr	Pro	Glu	Ile	Tyr	Val	Pro	Glu	Gln
465					470					475					480
Asp	Thr	Phe	Tyr	Lys	Gln	Asn	Pro	Asn	Ser	Ile	Val	Arg	Ala	Tyr	His
			485						490					495	
Ser	Ile	Ser	Leu	Leu	Leu	Pro	Asp	Gly	Arg	Val	Phe	Asn	Gly	Gly	Gly
			500					505					510		
Gly	Leu	Cys	Gly	Asp	Cys	Thr	Thr	Asn	His	Phe	Asp	Ala	Gln	Ile	Phe
		515					520					525			
Thr	Pro	Asn	Tyr	Leu	Tyr	Asp	Ser	Asn	Gly	Asn	Leu	Ala	Thr	Arg	Pro
	530					535						540			
Lys	Ile	Thr	Arg	Thr	Ser	Thr	Gln	Ser	Val	Lys	Val	Gly	Gly	Arg	Ile
545					550					555					560
Thr	Ile	Ser	Thr	Asp	Ser	Ser	Ile	Ser	Lys	Ala	Ser	Leu	Ile	Arg	Tyr
				565					570					575	
Gly	Thr	Ala	Thr	His	Thr	Val	Asn	Thr	Asp	Gln	Arg	Arg	Ile	Pro	Leu
			580					585					590		
Thr	Leu	Thr	Asn	Asn	Gly	Gly	Asn	Ser	Tyr	Ser	Phe	Gln	Val	Pro	Ser
		595					600					605			
Asp	Ser	Gly	Val	Ala	Leu	Pro	Gly	Tyr	Trp	Met	Leu	Phe	Val	Met	Asn
	610					615					620				
Ser	Ala	Gly	Val	Pro	Ser	Val	Ala	Ser	Thr	Ile	Arg	Val	Thr	Gln	
625					630					635					

<210> 16
 <211> 639
 <212> PRT
 <213> Dactylium dendroides

<400> 16

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Thr	Cys	Asp	Ser	Ala	Gln	Ser	Gly	Asn	Glu	Cys	Asn	Lys	Ala	Ile	Asp
			20					25					30		
Gly	Asn	Lys	Asp	Thr	Phe	Trp	His	Thr	Phe	Tyr	Gly	Ala	Asn	Gly	Asp
		35					40					45			
Pro	Lys	Pro	Pro	His	Thr	Tyr	Thr	Ile	Asp	Met	Lys	Thr	Thr	Gln	Asn
	50					55					60				
Val	Asn	Gly	Leu	Ser	Val	Leu	Pro	Arg	Gln	Asp	Gly	Asn	Gln	Asn	Gly
65					70					75					80
Trp	Ile	Gly	Arg	His	Glu	Val	Tyr	Leu	Ser	Ser	Asp	Gly	Thr	Asn	Trp
				85					90					95	
Gly	Ser	Pro	Val	Ala	Ser	Gly	Ser	Trp	Phe	Ala	Asp	Ser	Thr	Thr	Lys
			100					105					110		
Tyr	Ser	Asn	Phe	Glu	Thr	Arg	Pro	Ala	Arg	Tyr	Val	Arg	Leu	Val	Ala

		115					120					125					
Ile	Thr	Glu	Ala	Asn	Gly	Gln	Pro	Trp	Thr	Ser	Ile	Ala	Glu	Ile	Asn		
	130					135					140						
Val	Phe	Gln	Ala	Ser	Ser	Tyr	Thr	Ala	Pro	Gln	Pro	Gly	Leu	Gly	Arg		
145					150					155					160		
Trp	Gly	Pro	Thr	Ile	Asp	Leu	Pro	Ile	Val	Pro	Ala	Ala	Ala	Ala	Ile		
				165					170						175		
Glu	Pro	Thr	Ser	Gly	Arg	Val	Leu	Met	Trp	Ser	Ser	Tyr	Arg	Asn	Asp		
			180					185						190			
Ala	Phe	Gly	Gly	Ser	Pro	Gly	Gly	Ile	Thr	Leu	Thr	Ser	Ser	Trp	Asp		
		195					200						205				
Pro	Ser	Thr	Gly	Ile	Val	Ser	Asp	Arg	Thr	Val	Thr	Val	Thr	Lys	His		
	210					215						220					
Asp	Met	Phe	Cys	Pro	Gly	Ile	Ser	Met	Asp	Gly	Asn	Gly	Gln	Ile	Val		
225					230					235					240		
Val	Thr	Gly	Gly	Asn	Asp	Ala	Lys	Lys	Thr	Ser	Leu	Tyr	Asp	Ser	Ser		
				245					250						255		
Ser	Asp	Ser	Trp	Ile	Pro	Gly	Pro	Asp	Met	Gln	Val	Ala	Arg	Gly	Tyr		
			260					265						270			
Gln	Ser	Ser	Ala	Thr	Met	Ser	Asp	Gly	Arg	Val	Phe	Thr	Ile	Gly	Gly		
		275					280							285			
Ser	Trp	Ser	Gly	Gly	Val	Phe	Glu	Lys	Asn	Gly	Glu	Val	Tyr	Ser	Pro		
	290					295					300						
Ser	Ser	Lys	Thr	Trp	Thr	Ser	Leu	Pro	Asn	Ala	Lys	Val	Asn	Pro	Met		
305					310					315					320		
Leu	Thr	Ala	Asp	Lys	Gln	Gly	Leu	Tyr	Arg	Ser	Asp	Asn	His	Ala	Trp		
				325					330						335		
Leu	Phe	Gly	Trp	Lys	Lys	Gly	Ser	Val	Phe	Gln	Ala	Gly	Pro	Ser	Thr		
			340					345						350			
Ala	Met	Asn	Trp	Tyr	Tyr	Thr	Ser	Gly	Ser	Gly	Asp	Val	Lys	Ser	Ala		
		355					360					365					
Gly	Lys	Arg	Gln	Ser	Asn	Arg	Gly	Val	Ala	Pro	Asp	Ala	Met	Cys	Gly		
	370					375					380						
Asn	Ala	Val	Met	Tyr	Asp	Ala	Val	Lys	Gly	Lys	Ile	Leu	Thr	Phe	Gly		
385					390					395					400		
Gly	Ser	Pro	Asp	Tyr	Gln	Asp	Ser	Asp	Ala	Thr	Thr	Asn	Ala	His	Ile		
				405					410						415		
Ile	Thr	Leu	Gly	Glu	Pro	Gly	Thr	Ser	Pro	Asn	Thr	Val	Phe	Ala	Ser		
			420					425						430			
Asn	Gly	Leu	Tyr	Phe	Ala	Arg	Thr	Phe	His	Thr	Ser	Val	Val	Leu	Pro		
		435					440							445			
Asp	Gly	Ser	Thr	Phe	Ile	Thr	Gly	Gly	Gln	Arg	Arg	Gly	Ile	Pro	Phe		
	450					455					460						
Glu	Asp	Ser	Thr	Pro	Val	Phe	Thr	Pro	Glu	Ile	Tyr	Val	Pro	Glu	Gln		
465					470					475					480		
Asp	Thr	Phe	Tyr	Lys	Gln	Asn	Pro	Asn	Ser	Ile	Val	Arg	Ala	Tyr	His		
				485					490						495		
Ser	Ile	Ser	Leu	Leu	Leu	Pro	Asp	Gly	Arg	Val	Phe	Asn	Gly	Gly	Gly		

			500					505					510				
Gly	Leu	Cys	Gly	Asp	Cys	Thr	Thr	Asn	His	Phe	Asp	Ala	Gln	Ile	Phe		
		515						520					525				
Thr	Pro	Asn	Tyr	Leu	Tyr	Asn	Ser	Asn	Gly	Asn	Leu	Ala	Thr	Arg	Pro		
	530					535						540					
Lys	Ile	Thr	Arg	Thr	Ser	Thr	Gln	Ser	Val	Lys	Val	Gly	Gly	Arg	Ile		
545					550					555					560		
Thr	Ile	Ser	Thr	Asp	Ser	Ser	Ile	Ser	Lys	Ala	Ser	Leu	Ile	Arg	Tyr		
			565						570					575			
Gly	Thr	Ala	Thr	His	Thr	Val	Asn	Thr	Asp	Gln	Arg	Arg	Ile	Pro	Leu		
		580						585					590				
Thr	Leu	Thr	Asn	Asn	Gly	Gly	Asn	Ser	Tyr	Ser	Phe	Gln	Val	Pro	Ser		
	595					600						605					
Asp	Ser	Gly	Val	Ala	Leu	Pro	Gly	Tyr	Trp	Met	Leu	Phe	Val	Met	Asn		
	610					615					620						
Ser	Ala	Gly	Val	Pro	Ser	Val	Ala	Ser	Thr	Ile	Arg	Val	Thr	Gln			
625					630					635							

<210> 17
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 <212> PFT
 <213> Dactylium dendroides

<400> 17

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Thr	Cys	Asp	Ser	Ala	Gln	Ser	Gly	Asn	Glu	Cys	Asn	Lys	Ala	Ile	Asp		
			20					25					30				
Gly	Asn	Lys	Asp	Thr	Phe	Trp	His	Thr	Phe	Tyr	Gly	Ala	Asn	Gly	Asp		
	35					40						45					
Pro	Lys	Pro	Pro	His	Thr	Tyr	Thr	Ile	Asp	Met	Lys	Thr	Thr	Gln	Asn		
	50				55						60						
Val	Asn	Gly	Leu	Ser	Val	Leu	Pro	Arg	Gln	Asp	Gly	Asn	Gln	Asn	Gly		
65					70				75					80			
Trp	Ile	Gly	Arg	His	Glu	Val	Tyr	Leu	Ser	Ser	Asp	Gly	Thr	Asn	Trp		
			85					90						95			
Gly	Ser	Pro	Val	Ala	Ser	Gly	Ser	Trp	Phe	Ala	Asp	Ser	Thr	Thr	Lys		
		100						105					110				
Tyr	Ser	Asn	Phe	Glu	Thr	Arg	Pro	Ala	Arg	Tyr	Val	Arg	Leu	Val	Ala		
	115						120					125					
Ile	Thr	Glu	Ala	Asn	Gly	Gln	Pro	Trp	Thr	Ser	Ile	Ala	Glu	Ile	Asn		
	130				135						140						
Val	Phe	Gln	Ala	Ser	Ser	Tyr	Thr	Ala	Pro	Gln	Pro	Gly	Leu	Gly	Arg		
145					150					155					160		
Trp	Gly	Pro	Thr	Ile	Asp	Leu	Pro	Ile	Val	Pro	Ala	Ala	Ala	Ala	Ile		
			165						170					175			
Glu	Pro	Thr	Ser	Gly	Arg	Val	Leu	Met	Trp	Ser	Ser	Tyr	Arg	Asn	Asp		
		180						185					190				

Ala	Phe	Glu	Gly	Ser	Pro	Gly	Gly	Ile	Thr	Leu	Thr	Ser	Ser	Trp	Asp
		195					200					205			
Pro	Ser	Thr	Gly	Ile	Val	Ser	Asp	Arg	Thr	Val	Thr	Val	Thr	Lys	His
	210					215					220				
Asp	Met	Phe	Cys	Pro	Gly	Ile	Ser	Met	Asp	Gly	Asn	Gly	Gln	Ile	Val
225					230					235					240
Val	Thr	Gly	Gly	Asn	Asp	Ala	Lys	Lys	Thr	Ser	Leu	Tyr	Asp	Ser	Ser
				245					250					255	
Ser	Asp	Ser	Trp	Ile	Pro	Gly	Pro	Asp	Met	Gln	Val	Ala	Arg	Gly	Tyr
			260					265					270		
Gln	Ser	Ser	Ala	Thr	Met	Ser	Asp	Gly	Arg	Val	Phe	Thr	Ile	Gly	Gly
	275						280					285			
Ser	Trp	Ser	Gly	Gly	Val	Phe	Glu	Lys	Asn	Gly	Glu	Val	Tyr	Ser	Pro
	290					295					300				
Ser	Ser	Lys	Thr	Trp	Thr	Ser	Leu	Pro	Asn	Ala	Lys	Val	Asn	Pro	Met
305					310					315					320
Leu	Thr	Ala	Asp	Lys	Gln	Gly	Leu	Tyr	Arg	Ser	Asp	Asn	His	Ala	Trp
				325					330					335	
Leu	Phe	Gly	Trp	Lys	Lys	Gly	Ser	Val	Phe	Gln	Ala	Gly	Pro	Ser	Thr
			340					345					350		
Ala	Met	Asn	Trp	Tyr	Tyr	Thr	Ser	Gly	Ser	Gly	Asp	Val	Lys	Ser	Ala
		355					360					365			
Gly	Lys	Arg	Gln	Ser	Asn	Arg	Gly	Val	Ala	Pro	Asp	Ala	Met	Cys	Gly
	370					375					380				
Asn	Ala	Val	Met	Tyr	Asp	Ala	Val	Lys	Gly	Lys	Ile	Leu	Thr	Phe	Gly
385					390					395					400
Gly	Ser	Pro	Asp	Tyr	Gln	Asp	Ser	Asp	Ala	Thr	Thr	Asn	Ala	His	Ile
				405					410					415	
Ile	Thr	Leu	Gly	Glu	Pro	Gly	Thr	Ser	Pro	Asn	Thr	Val	Phe	Ala	Ser
			420				425						430		
Asn	Gly	Leu	Tyr	Phe	Ala	Arg	Thr	Phe	His	Thr	Ser	Val	Val	Leu	Pro
		435					440					445			
Asp	Gly	Ser	Thr	Phe	Ile	Thr	Gly	Gly	Gln	Arg	Arg	Gly	Ile	Pro	Phe
	450					455					460				
Glu	Asp	Ser	Thr	Pro	Val	Phe	Thr	Pro	Glu	Ile	Tyr	Val	Pro	Glu	Gln
465					470					475					480
Asp	Thr	Phe	Tyr	Lys	Gln	Asn	Pro	Asn	Ser	Ile	Val	Arg	Ala	Tyr	His
				485					490					495	
Ser	Ile	Ser	Leu	Leu	Leu	Pro	Asp	Gly	Arg	Val	Phe	Asn	Gly	Gly	Gly
			500					505					510		
Gly	Leu	Cys	Gly	Asp	Cys	Thr	Thr	Asn	His	Phe	Asp	Ala	Gln	Ile	Phe
		515					520					525			
Thr	Pro	Asn	Tyr	Leu	Tyr	Asp	Ser	Asn	Gly	Asn	Leu	Ala	Thr	Arg	Pro
	530					535					540				
Lys	Ile	Thr	Arg	Thr	Ser	Thr	Gln	Ser	Val	Lys	Val	Gly	Gly	Arg	Ile
545					550					555					560
Thr	Ile	Ser	Thr	Asp	Ser	Ser	Ile	Ser	Lys	Ala	Ser	Leu	Ile	Arg	Tyr
				565					570					575	

Gly	Thr	Ala	Thr	His	Thr	Val	Asn	Thr	Asp	Gln	Arg	Arg	Ile	Pro	Leu
			580					535					590		
Thr	Leu	Thr	Asn	Asn	Gly	Gly	Asn	Ser	Tyr	Ser	Phe	Gln	Val	Pro	Ser
		595					600					605			
Asp	Ser	Gly	Val	Ala	Leu	Pro	Gly	Tyr	Trp	Met	Leu	Phe	Val	Met	Asn
	610					615					620				
Ser	Ala	Gly	Val	Pro	Ser	Val	Ala	Ser	Thr	Ile	Arg	Val	Thr	Gln	
625					630					635					

<210> 18
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 <212> PRT
 <213> Dactylium dendroides

<400> 18

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Thr	Cys	Asp	Ser	Ala	Gln	Ser	Gly	Asn	Glu	Cys	Asn	Lys	Ala	Ile	Asp
		20						25				30			
Gly	Asn	Lys	Asp	Thr	Phe	Trp	His	Thr	Phe	Tyr	Gly	Ala	Asn	Gly	Asp
	35					40					45				
Pro	Lys	Pro	Pro	His	Thr	Tyr	Thr	Ile	Asp	Met	Lys	Thr	Thr	Gln	Asn
	50					55					60				
Val	Asn	Gly	Leu	Ser	Met	Leu	Pro	Arg	Gln	Asp	Gly	Asn	Gln	Asn	Gly
65					70					75					80
Trp	Ile	Gly	Arg	His	Glu	Val	Tyr	Leu	Ser	Ser	Asp	Gly	Thr	Asn	Trp
				85					90					95	
Gly	Ser	Pro	Val	Ala	Ser	Gly	Ser	Trp	Phe	Ala	Asp	Ser	Thr	Thr	Lys
		100						105					110		
Tyr	Ser	Asn	Phe	Glu	Thr	Arg	Pro	Ala	Arg	Tyr	Val	Arg	Leu	Val	Ala
		115					120					125			
Ile	Thr	Glu	Ala	Asn	Gly	Gln	Pro	Trp	Thr	Ser	Ile	Ala	Glu	Ile	Asn
	130					135					140				
Val	Phe	Gln	Ala	Ser	Ser	Tyr	Thr	Ala	Pro	Gln	Pro	Gly	Leu	Gly	Arg
145					150					155					160
Trp	Gly	Pro	Thr	Ile	Asp	Leu	Pro	Ile	Val	Pro	Ala	Ala	Ala	Ala	Ile
				165					170					175	
Glu	Pro	Thr	Ser	Gly	Arg	Val	Leu	Met	Trp	Ser	Ser	Tyr	Arg	Asn	Asp
		180						185					190		
Ala	Phe	Gly	Gly	Ser	Pro	Gly	Gly	Ile	Thr	Leu	Thr	Ser	Ser	Trp	Asp
	195						200					205			
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Val	Thr	Gly	Gly	Asn	Asp	Ala	Lys	Lys	Thr	Ser	Leu	Tyr	Asp	Ser	Ser
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Ser	Ser	Lys	Thr	Trp	Thr	Ser	Leu	Pro	Asn	Ala	Lys	Val	Asn	Pro	Met
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Leu	Thr	Ala	Asp	Lys	Gln	Gly	Leu	Tyr	Arg	Ser	Asp	Asn	His	Ala	Trp
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Asn	Ala	Val	Met	Tyr	Asp	Ala	Val	Lys	Gly	Lys	Ile	Leu	Thr	Phe	Gly
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Gly	Ser	Pro	Asp	Tyr	Gln	Asp	Ser	Asp	Ala	Thr	Thr	Asp	Ala	His	Ile
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Asp	Thr	Phe	Tyr	Lys	Gln	Asn	Pro	Asn	Ser	Ile	Val	Arg	Val	Tyr	His
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Trp	Ile	Gly	Arg	His	Glu	Val	Tyr	Leu	Ser	Ser	Asp	Gly	Thr	Asn	Trp
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Trp	Gly	Pro	Thr	Ile	Asp	Leu	Pro	Ile	Val	Pro	Ala	Ala	Ala	Ala	Ile
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Ala	Phe	Gly	Gly	Ser	Pro	Gly	Gly	Ile	Thr	Leu	Thr	Ser	Ser	Trp	Asp
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Pro	Ser	Thr	Gly	Ile	Val	Ser	Asp	Arg	Thr	Val	Thr	Val	Thr	Lys	His
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Val	Thr	Gly	Gly	Asn	Asp	Ala	Lys	Lys	Thr	Ser	Leu	Tyr	Asp	Ser	Ser
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Ser	Trp	Ser	Gly	Gly	Val	Phe	Glu	Lys	Asn	Gly	Glu	Val	Tyr	Ser	Pro
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Tyr	Ser	Asn	Phe	Glu	Thr	Arg	Pro	Ala	Arg	Tyr	Val	Arg	Leu	Val	Ala		
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Glu	Pro	Thr	Ser	Gly	Arg	Val	Leu	Met	Trp	Ser	Ser	Tyr	Arg	Asn	Asp		
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Ala	Phe	Gly	Gly	Ser	Pro	Gly	Gly	Ile	Thr	Leu	Thr	Ser	Ser	Trp	Asp		
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225					230					235					240		
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Asp	Gly	Ser	Thr	Phe	Ile	Thr	Gly	Gly	Gln	Arg	Arg	Gly	Ile	Pro	Phe		
	450					455				460							
Glu	Asp	Ser	Thr	Pro	Val	Phe	Thr	Pro	Glu	Ile	Tyr	Val	Pro	Glu	Gln		
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Asp	Ser	Gly	Val	Ala	Leu	Pro	Gly	Tyr	Trp	Met	Leu	Phe	Val	Met	Asn		
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Pro	Lys	Pro	Pro	His	Thr	Tyr	Thr	Ile	Asp	Met	Lys	Thr	Thr	Gln	Asn		
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225					230					235					240
Val	Thr	Gly	Gly	Asn	Asp	Ala	Lys	Lys	Thr	Ser	Leu	Tyr	Asp	Ser	Ser
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Ser	Asp	Ser	Trp	Ile	Pro	Gly	Pro	Asp	Met	Gln	Val	Ala	Arg	Gly	Tyr
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Ser	Ser	Lys	Thr	Trp	Thr	Ser	Leu	Pro	Asn	Ala	Lys	Val	Asn	Pro	Met
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Thr	Leu	Thr	Asn	Asn	Gly	Gly	Asn	Ser	Tyr	Ser	Phe	Gln	Val	Pro	Ser
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"n" at position 18 is either a, t, or c.

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